(4) It must be demonstrated in flight that when restarting engines following a false start, all fuel or vapor is discharged in such a way that it does not constitute a fire hazard.

(f) *Restart envelope.* An altitude and airspeed envelope must be established for the airplane for in-flight engine restarting and each installed engine must have a restart capability within that envelope.

(g) *Restart capability.* For turbine engine powered airplanes, if the minimum windmilling speed of the engines, following the in-flight shutdown of all engines, is insufficient to provide the necessary electrical power for engine ignition, a power source independent of the engine-driven electrical power generating system must be provided to permit in-flight engine ignition for restarting.

[Amdt. 23–14, 38 FR 31822, Nov. 19, 1973]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting § 23.903, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and on GPO Access.

§ 23.904 Automatic power reserve system.

If installed, an automatic power reserve (APR) system that automatically advances the power or thrust on the operating engine(s), when any engine fails during takeoff, must comply with appendix H of this part.

[Doc. No. 26344, 58 FR 18970, Apr. 9, 1993]

§ 23.905 Propellers.

(a) Each propeller must have a type certificate.

(b) Engine power and propeller shaft rotational speed may not exceed the limits for which the propeller is certificated.

(c) Each featherable propeller must have a means to unfeather it in flight.

(d) Each component of the propeller blade pitch control system must meet the requirements of § 35.42 of this chapter.

(e) All areas of the airplane forward of the pusher propeller that are likely to accumulate and shed ice into the propeller disc during any operating condition must be suitably protected to prevent ice formation, or it must be shown that any ice shed into the propeller disc will not create a hazardous condition.

(f) Each pusher propeller must be marked so that the disc is conspicuous under normal daylight ground conditions.

(g) If the engine exhaust gases are discharged into the pusher propeller disc, it must be shown by tests, or analysis supported by tests, that the propeller is capable of continuous safe operation.

(h) All engine cowling, access doors, and other removable items must be designed to ensure that they will not separate from the airplane and contact the pusher propeller.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23–26, 45 FR 60171, Sept. 11, 1980; Amdt. 23–29, 49 FR 6847, Feb. 23, 1984; Amdt. 23–43, 58 FR 18970, Apr. 9, 1993]

§ 23.907 Propeller vibration.

(a) Each propeller other than a conventional fixed-pitch wooden propeller must be shown to have vibration stresses, in normal operating conditions, that do not exceed values that have been shown by the propeller manufacturer to be safe for continuous operation. This must be shown by—

(1) Measurement of stresses through direct testing of the propeller;

(2) Comparison with similar installations for which these measurements have been made; or

(3) Any other acceptable test method or service experience that proves the safety of the installation.

(b) Proof of safe vibration characteristics for any type of propeller, except for conventional, fixed-pitch, wood propellers must be shown where necessary.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964; 30 FR 258, Jan. 9, 1965, as amended by Amdt. 23–51, 61 FR 5136, Feb. 9, 1996]

§ 23.909 Turbocharger systems.

(a) Each turbocharger must be approved under the engine type certificate or it must be shown that the turbocharger system, while in its normal engine installation and operating in the engine environment—

(1) Can withstand, without defect, an endurance test of 150 hours that meets the applicable requirements of § 33.49 of this subchapter; and

(2) Will have no adverse effect upon the engine.

(b) Control system malfunctions, vibrations, and abnormal speeds and temperatures expected in service may not damage the turbocharger compressor or turbine.

(c) Each turbocharger case must be able to contain fragments of a compressor or turbine that fails at the highest speed that is obtainable with normal speed control devices inoperative.

(d) Each intercooler installation, where provided, must comply with the following—

(1) The mounting provisions of the intercooler must be designed to withstand the loads imposed on the system;

(2) It must be shown that, under the installed vibration environment, the intercooler will not fail in a manner allowing portions of the intercooler to be ingested by the engine; and

(3) Airflow through the intercooler must not discharge directly on any airplane component (e.g., windshield) unless such discharge is shown to cause no hazard to the airplane under all operating conditions.

(e) Engine power, cooling characteristics, operating limits, and procedures affected by the turbocharger system installations must be evaluated. Turbocharger operating procedures and limitations must be included in the Airplane Flight Manual in accordance with § 23.1581.

[Amdt. 23–7, 34 FR 13092, Aug. 13, 1969, as amended by Amdt. 23–43, 58 FR 18970, Apr. 9, 1993]

§ 23.925 Propeller clearance.

Unless smaller clearances are substantiated, propeller clearances, with the airplane at the most adverse combination of weight and center of gravity, and with the propeller in the most adverse pitch position, may not be less than the following:

(a) *Ground clearance.* There must be a clearance of at least seven inches (for each airplane with nose wheel landing gear) or nine inches (for each airplane with tail wheel landing gear) between each propeller and the ground with the landing gear statically deflected and in the level, normal takeoff, or taxing attitude, whichever is most critical. In addition, for each airplane with conventional landing gear struts using fluid or mechanical means for absorbing landing shocks, there must be positive clearance between the propeller and the ground in the level takeoff attitude with the critical tire completely deflated and the corresponding landing gear strut bottomed. Positive clearance for airplanes using leaf spring struts is shown with a deflection corresponding to 1.5*g*.

(b) *Aft-mounted propellers.* In addition to the clearances specified in paragraph (a) of this section, an airplane with an aft mounted propeller must be designed such that the propeller will not contact the runway surface when the airplane is in the maximum pitch attitude attainable during normal takeoffs and landings.

(c) *Water clearance.* There must be a clearance of at least 18 inches between each propeller and the water, unless compliance with § 23.239 can be shown with a lesser clearance.

(d) *Structural clearance.* There must be—

(1) At least one inch radial clearance between the blade tips and the airplane structure, plus any additional radial clearance necessary to prevent harmful vibration;

(2) At least one-half inch longitudinal clearance between the propeller blades or cuffs and stationary parts of the airplane; and

(3) Positive clearance between other rotating parts of the propeller or spinner and stationary parts of the airplane.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23–43, 58 FR 18971, Apr. 9, 1993; Amdt. 23–51, 61 FR 5136, Feb. 9, 1996; Amdt. 23–48, 61 FR 5148, Feb. 9, 1996]

§ 23.929 Engine installation ice protection.

Propellers (except wooden propellers) and other components of complete engine installations must be protected against the accumulation of ice as necessary to enable satisfactory functioning without appreciable loss of